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**Prospective study of individual characteristics and post-traumatic stress disorder (PTSD)
symptoms following childbirth: birth satisfaction as a moderator**

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Prospective study of individual characteristics and post-traumatic stress disorder (PTSD) symptoms following childbirth: birth satisfaction as a moderator

Abstract

Objective: The goal of this study was to: (1) examine the association between childbirth-related posttraumatic stress disorder (CB-PTSD) symptoms and possible risk factors of previous trauma, individual characteristics (neuroticism, anxiety sensitivity, and resilience), type of birth, and birth satisfaction; and (2) explore whether birth satisfaction moderates any association between individual characteristics and CB-PTSD symptoms.

Method: This was a longitudinal questionnaire study during pregnancy and postpartum. Pregnant women ($N = 396$) were recruited from antenatal clinics and completed questionnaires during mid-late pregnancy (T1) and 6-12 weeks after childbirth (T2). T1 questionnaires measured anxiety sensitivity (Anxiety Sensitivity Index, ASI), neuroticism (IPIP-50 neuroticism subscale), resilience (Brief Resilience Scale, BRS), and trauma history. T2 questionnaires measured birth satisfaction and CB-PTSD (Birth-related and General symptoms subscales).

Results: Regression analysis showed that previous sexual trauma, higher levels of neuroticism and lower levels of birth satisfaction predicted higher levels of CB-PTSD symptoms. Anxiety sensitivity and resilience were not significant predictors of CB-PTSD. Additionally, birth satisfaction moderated the relationship between higher neuroticism and higher levels of CB-PTSD (Total and General symptoms), and between lower resilience and higher CB-PTSD General symptoms. Effects were stronger when low birth satisfaction was reported.

Conclusions: Individual characteristics and birth satisfaction interact in the development of PTSD following childbirth, with previous traumatic experiences playing an additional role. These findings can inform screening and care pathways for women at greater risk.

Keywords: PTSD, childbirth, neuroticism, resilience, anxiety sensitivity, sexual assault, birth satisfaction

Clinical impact statement

PTSD following childbirth is affected by many factors. Vulnerability factors before birth include individual characteristics (e.g. neuroticism) and previous traumatic experiences (e.g. sexual assault or previous traumatic childbirth). In this study, neuroticism and resilience interacted with birth satisfaction, meaning that women with high levels of neuroticism and low levels of resilience who reported low levels of birth satisfaction were at the highest risk for developing PTSD symptoms following childbirth. Women with previous traumatic experiences and high neuroticism are more likely to react negatively to stressful situations, such as childbirth, and therefore should be provided with special attention and trauma-informed care.

Introduction

Childbirth is a complex event that is physically and emotionally challenging for women. Despite leading to the happy event of the arrival of a baby, childbirth is associated with uncertainty, fear and unpredictability (Brekalo et al., 2024; Colciago et al., 2022). It can involve obstetric interventions and complications for the mother or baby, which can make childbirth a traumatic experience for some women (El Founti Khsim et al., 2022). It should be noted that traumatic birth experiences are in the eye of the beholder (Beck, 2020) and even a physiologically normal birth without any medical interventions and complications can be experienced as traumatic (Watson et al., 2021). Systematic reviews suggest one in three women experience childbirth as a traumatic event, about 4% develop childbirth-related posttraumatic stress disorder (CB-PTSD) according to psychiatric diagnostic criteria and about 12% show clinically significant levels of posttraumatic stress symptoms (Dikmen Yildiz et al., 2017; Heyne et al., 2022).

CB-PTSD has potential adverse consequences for mothers, infants, and the family. It is highly comorbid with postpartum depression and is associated with poor mother-infant bonding (Nakić Radoš, Matijaš, Anđelinović et al., 2020). Also, women with CB-PTSD tend to avoid future pregnancies and if they do get pregnant again they are more likely to report fear of childbirth and avoid prenatal check-ups (Stramrood & Slade, 2017).

Considering these adverse outcomes, it is important to investigate the mechanisms underlying the development of CB-PTSD. Meta-analyses identify various vulnerabilities and risk factors for CB-PTSD, such as previous mental illness, depression, and anxiety before childbirth (El Founti Khsim et al., 2022). Previous traumatic experiences, especially sexual assault, are also associated with CB-PTSD (El Founti Khsim et al., 2022). Reviews of the evidence conclude that birth-related factors such as negative birth experiences, low birth satisfaction, emergency obstetric interventions (i.e., instrumental vaginal birth or emergency caesarean section), and poor social support during childbirth also contribute to CB-PTSD (Ayers et al., 2016; Carter et al., 2022; El Founti Khsim et al., 2022).

As childbirth is a predictable event, it is possible to conduct longitudinal studies of vulnerability and risk factors for CB-PTSD already present before childbirth. However, studies to date have focused on a limited number of possible factors. Very few studies have examined personality traits as a factor which may predispose women to CB-PTSD. Personality has been suggested as having a role in PTSD through high negative emotionality such as neuroticism. Neuroticism is characterized as a predisposition to consistently encounter negative emotions when confronted with diverse stressors, is implied in many anxiety and mood disorders (Barlow et al., 2021). It is suggested that neuroticism contributes to the emergence of PTSD symptoms by magnifying the emotional impact, accessibility, and centrality of traumatic memories (Ogle et al., 2017). However, one prospective study found that neuroticism did not lead to more reactivity to adverse events (Engelhard et al., 2009). In peripartum samples, a cross-sectional study found that neuroticism was associated with CB-PTSD symptoms measured in the first postpartum year (Handelzalts et al., 2022). However, longitudinal studies where neuroticism was measured during pregnancy found that neuroticism was more strongly associated with acute stress responses three to five days after childbirth than with CB-PTSD symptoms eight weeks after childbirth (Srkalović Imširagić et al., 2017); or it was associated with CB-PTSD symptoms eight weeks postpartum, but was not a maintaining factor for CB-PTSD symptoms two years postpartum (Garthus-Niegel et al., 2015).

Another individual characteristic that might be a risk factor for CB-PTSD is anxiety sensitivity, which is defined as a fear of anxiety-related symptoms (Taylor et al., 2020). Anxiety sensitivity comprises a broader overarching factor and three specific sub-factors: fear of bodily sensations, fear of cognitive incapacity, and concerns related to public appearances. In a meta-analysis, anxiety sensitivity was found to be associated with PTSD, especially in women, and it was suggested that anxiety sensitivity for physical symptoms specifically is a risk factor for PTSD (Olatunji & Wolitzky-Taylor, 2009). Traumatic events can involve various physical sensations, and this is especially the case for labour and birth. Therefore, women with a preexisting fear of physical

sensations may have heightened emotional reactivity during childbirth. Research that looks at the relationship between anxiety sensitivity and PTSD after the traumatic event finds a bi-directional relationship where both predict each other at later timepoints (Marshall et al., 2010). Childbirth therefore offers an important opportunity to measure anxiety sensitivity before the traumatic event, i.e. before childbirth. Two studies have done this (Keogh et al., 2002; Verreault et al., 2012) and both found that prepartum anxiety sensitivity increased the risk of PTSD symptoms following childbirth. However, the study by Verreault et al. (2012) did not examine different dimensions of anxiety sensitivity (i.e., physical, cognitive, social). The study by Keogh et al. (2002) found that the social dimension of anxiety sensitivity was a significant predictor of PTSD, but the non-clinical sample was very small with only 40 women. Therefore, it remains to be determined which of the anxiety sensitivity dimensions contributes the most to the development of the CB-PTSD.

In understanding the development of CB-PTSD it is also important to take into account protective factors, such as resilience, i.e. the capacity to effectively adjust to adversities and trauma (Horn & Feder, 2018). The transition to parenthood is seen as a vulnerable time where resilience and adaptation is important (Young et al., 2019). Ayers (2017) noted that previous studies rarely investigated resilience in the context of CB-PTSD following childbirth and this has not changed much since. Dikmen Yildiz et al. (2018) examined longitudinal trajectories of CB-PTSD after traumatic childbirth and found that 62% of women were resilient to PTSD six months after birth, showing no or only mild symptoms over that period. A qualitative study with women who experienced birth trauma emphasised the importance of resilience in the process of recovering from trauma, where women utilised both internal and external resources (Brown et al., 2022). However, these studies did not measure resilience before the trauma so are not able to establish the direction of causality.

This study therefore aimed to: (1) examine the association between PTSD symptoms and possible risk factors of previous trauma - individual characteristics of neuroticism, anxiety sensitivity and resilience, type of birth, and birth satisfaction; and (2) explore whether birth satisfaction moderates any association between individual characteristics and CB-PTSD symptoms. In line with

previous literature we expected previous traumatic experiences, individual characteristics, birth with interventions (instrumental vaginal birth and emergency caesarean section), and low birth satisfaction would be associated with higher levels of CB-PTSD symptoms. However, we could not predict which aspect of anxiety sensitivity would be more predictive. Also, we could not speculate over whether the pattern of associations would be similar for both dimensions of CB-PTSD symptoms, i.e. Birth-related symptoms, including re-experiencing and avoidance, and General symptoms, including negative cognition and mood and hyperarousal. Finally, given the lack of studies and inconsistent findings on birth satisfaction as a moderator between individual characteristics and PTSD symptoms, we conducted an exploratory examination of this.

Methods

Design

A longitudinal questionnaire study with T1 measures completed in pregnancy (mean 35.59 weeks, *Sd* = 4.63) and T2 measures after childbirth (mean 7.86 weeks, *Sd* = 1.64). This research was conducted as part of the International Survey of Childbirth-Related Trauma (INTERSECT, www.intersectstudy.org).

Participants and Procedure

This study was approved by the Ethics Committee of the Catholic University of Croatia and the Ethics Committee of the Clinical Hospital "Sveti Duh". Pregnant women were approached by an obstetrician during routine antenatal appointments at the hospital. Women provided informed consent, filled out the first set of questionnaires and returned them in a sealed envelope, together with their contact information. Women were contacted 6-12 weeks postpartum based on the due date. They were contacted by e-mail and/or text message and sent a link to the online questionnaire. Participation in the study was voluntary and women could withdraw from the study at any stage without having to provide a reason.

We approached 573 women at T1 (without specific eligibility criteria), of whom 46 (8.0%) did not provide contact details. At T2 we contacted 527 women, of whom 412 completed questionnaires; however, 8 did not meet inclusion criteria (i.e., were outside the 6-12 weeks range), and 8 women were excluded due to missing data on the main variables. The final sample consisted of 396 women who completed questionnaires at both time points (69.1%).

Compared to women who did not complete both assessments, women who participated in both time points were significantly older ($t(565)=-2.34, p = .020$), more highly educated ($\chi^2(2)=16.67, p < .001$), lived in more urban area ($\chi^2(2) 14.20, p = .001$), reported more previous traumatic experiences of child abuse ($\chi^2(1)= 5.88, p = .015$) and natural disasters ($\chi^2(1)=9.73, p = .002$). However, they did not differ in parity, relationship status, past traumatic childbirth experiences, other traumatic events, neuroticism, anxiety sensitivity or resilience.

The final sample ($N = 396$) had a mean age of 31.73 years ($SD=4.99$; range 19-47 years), were mostly married (75.8%) or cohabiting (22.2%), and a small minority (2.0%) were single, separated or widowed. Most participants graduated from college or university (73.5%), lived in large urban areas (i.e., with over 100,000 citizens) (80.0%), and reported having an average or above-average (61.4%) household income compared to others (37.1%). A minority reported having a previously diagnosed mental illness (3.5%) and/or family psychiatric history (15.7%). Just over half the sample were primiparous (56.3%). In terms of the type of birth, 77.0% had a vaginal birth, 13.9% emergency caesarean section, 8.8% planned caesarean section, and 0.3% instrumental vaginal birth.

Instruments

The City Birth Trauma Scale (City BiTS; Ayers et al., 2018) consists of 20 items measuring PTSD symptoms following childbirth (with a rating scale from 0 to 3 to denote frequency) and an additional seven items covering other criteria from the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5, American Psychiatric Association, 2013) to determine the presence of CB-PTSD. The total symptom score is calculated based on these 20 items, with a possible score ranging from 0 to 60. A higher score indicates more frequent symptoms. Psychometric testing indicates there

are two subscales of Birth-related symptoms and General symptoms (Ayers et al., 2018; Handelzalts et al., 2018) which can be computed. The scale has been translated into Croatian (Nakić Radoš, Matijaš, Kuhar et al., 2020), with Cronbach α of .92 for both subscales. In the current study, the McDonald's ω was .90 for both subscales. This scale was used to determine the prevalence of PTSD after childbirth and as the main criterion variable in the study.

Anxiety Sensitivity Index (ASI; Reiss et al., 1986) measures fear of anxiety symptoms and related physical sensations. The ASI comprises 16 items across three factors: Physical Concerns, Psychological Concerns, and Social Concerns, with a 5-point rating scale, and a total score from 0 to 64, where a higher number indicates higher anxiety sensitivity. The scale has been translated and validated in Croatian, with Cronbach α of .88 for the total scale (Jurin et al., 2012). In this study, McDonald's ω was .88 and .81 for Physical and Psychological Concerns. However, it was not possible to calculate McDonald's ω on just two items for Social Concerns Scale. Cronbach's α for Social Concerns was poor at .43 so this subscale was not used in further analysis.

International Personality Item Pool-50 (IPIP-50; Mlačić & Goldberg, 2007) measures the big five personality traits: extraversion, emotional stability, conscientiousness, agreeableness, and intellect. The IPIP-50 was developed in Croatia with 10 items per subscale rated on a 5-point scale. For this study the emotional stability subscale was used and the scoring reversed so the scores range from 10 to 50 and a higher number indicates higher neuroticism. Cronbach's α was .87 in the original study. In the current study McDonald's ω was .89.

Brief Resilience Scale (BRS; Smith et al., 2008) is a 6-item scale that measures resilience to stress, or the individual capacity to buffer or recover from stress. The items are rated on a 5-point scale. Three items are reversely coded, and the total score is calculated as the average value (range 1 to 5), where a higher number indicates higher resilience. The scale was translated into Croatian, with Cronbach's α of .82 (Slišković & Burić, 2018). In this study, McDonald's ω was .84.

Birth Satisfaction Scale-Revised (BSS-R; Hollins Martin & Martin, 2011) is a 10-item scale that measures three aspects of birth satisfaction: stress experienced during childbirth; women's

personal attributes; and quality of care. Each item is rated on a 5-point scale from 0 to 4, with total scores ranging from 0 to 40 where a higher score indicates higher birth satisfaction. The scale was translated to Croatian, where the bi-factor structure of general and three specific factors was confirmed, and McDonald's ω of .85 for the total scale (Nakić Radoš et al., 2023). In the current study, McDonald's ω was .81 for the total scale but was below .70 for subscales. Therefore, only the total score was used in the analysis.

Demographic and obstetric characteristics were assessed with questions on maternal age, education, relationship status, socioeconomic status, and parity. Previous traumatic experiences were collected as a checklist for seven traumatic experiences (life-threatening illness, physical assault, sexual assault, military combat, child abuse, accident, natural disaster), and previous childbirth for multiparae. Each trauma type was coded separately (yes/no). After childbirth, the type of birth and complications during pregnancy and birth were collected.

Statistical analyses

Total scale scores were computed if a participant provided answers on at least 70% of items in each scale at T1 by imputing the average value. At T2 there were no missing data due to the online Google Forms settings not allowing questions to be missed. Power was calculated based on a medium effect size, significance level of 5%, power of 80%, and 10 predictors. It was calculated in G*Power (Faul et al., 2009) that at least 118 participants were needed which was exceeded. Scale reliability was calculated using McDonald's ω coefficient, which is a better alternative to Cronbach's α (Trizano-Hermosilla & Alvarado, 2016). Descriptive statistics were calculated, and associations were examined with Pearson r or Spearman rank coefficient depending on the type of variable. Prediction of PTSD symptoms was examined with hierarchical regression analysis (enter method), with variables in significant correlations entered as possible predictors. All analyses were conducted with IBM SPSS software for Windows 29.0. Moderation analysis was conducted with the PROCESS macro 4.2 version for SPSS (Hayes, 2022) and moderation graphs were produced with ModGraph-I (Jose, 2013).

Results

Prevalence of PTSD following childbirth

Thirteen percent of the sample met DSM-5 criteria for traumatic childbirth, as measured by believing that either they or their newborn would be seriously injured or would die. PTSD full diagnostic criteria according to DSM-5 was present in seven women (1.8%).

Factors associated with CB-PTSD

Bivariate correlations showed that from previous traumatic experiences, higher levels of CB-PTSD symptoms were associated with a history of sexual assault ($r_s=.14, p<.01$) in the whole sample, and with previous traumatic childbirth in multiparous women ($r_s=.24, p<.01$). Of the demographic variables, only parity ($r_s=-.16, p<.01$) and relationship status ($r_s=.11, p<.05$) were associated with CB-PTSD symptoms. Namely, multiparous and married women had lower levels of CB-PTSD symptoms.

Regarding individual characteristics, higher anxiety sensitivity, higher neuroticism, and lower resilience were significantly associated with higher CB-PTSD symptoms but these associations were weak to moderate (Table 1). Type of birth was associated with CB-PTSD symptoms, in that women who had an emergency caesarean section reported higher levels of CB-PTSD symptoms ($r_s=.12, p<.05$).

Hierarchical regression analyses of factors significantly associated with CB-PTSD symptoms were conducted separately for total CB-PTSD symptoms, Birth-related and General symptoms as criterion variables (Table 2). Relationship status, previous sexual trauma, parity and previous traumatic childbirth were entered in Step 1, which explained 7.5% of CB-PTSD symptoms variance. Individual characteristics of anxiety sensitivity, neuroticism and resilience were entered in Step 2, which explained an additional 13.2% of CB-PTSD symptoms variance. Finally, type of birth and birth satisfaction were entered in Step 3 and explained an additional 16.1% of CB-PTSD symptoms

variance. Significant predictors of CB-PTSD symptoms were previous sexual trauma, higher levels of neuroticism, and lower levels of birth satisfaction. Anxiety sensitivity and resilience were not significant predictors of CB-PTSD in this model.

When CB-PTSD subscales were examined different patterns of predictors were observed (Table 2). For General CB-PTSD symptoms, previous sexual trauma was not significant, but previous traumatic childbirth was a significant predictor (this was only in multiparous women, as primiparous women did not have previous childbirth experience). Neuroticism was a significant predictor for General symptoms only, but not for Birth-related symptoms. Birth satisfaction was a significant predictor for both subscales. Type of birth was significant only for the Birth-related symptoms, in that women who had emergency caesarean section reported higher levels of Birth-related CB-PTSD symptoms in comparison to women who had (non-instrumental) vaginal births. On the other hand, women who had planned caesarean sections reported lower levels of Birth-related CB-PTSD symptoms in comparison with women who had vaginal births. It is also interesting to note that in Step 2 when individual characteristics were entered this explained less of the variance in Birth-related symptoms and more of the variance in General symptoms (9.3% vs. 20.7%), while the type of birth and birth satisfaction added in Step 3 explained more of the variance for Birth-related symptoms and less of the variance for General symptoms (28.8% vs. 2.0%).

Birth satisfaction as a moderator between individual characteristics and CB-PTSD symptoms

Moderation analyses were conducted with birth satisfaction as a moderator of the association between individual characteristics (neuroticism, anxiety sensitivity, and resilience) and CB-PTSD or its subscales (Table 3). Birth satisfaction was a significant moderator of the association between neuroticism and CB-PTSD Total symptoms and General symptoms, and of the association between resilience and CB-PTSD General symptoms. Higher levels of neuroticism were associated with higher CB-PTSD General symptoms, and the effect was significantly stronger at lower levels of birth satisfaction (Figure 1a). Lower levels of resilience were associated with higher CB-PTSD General

symptoms, and this effect was stronger at lower levels of birth satisfaction (Figure 1b). Birth satisfaction was not a significant moderator in the relationship between dimensions of anxiety sensitivity and CB-PTSD symptoms.

Discussion

Many factors can contribute to the development of CB-PTSD. However, research so far has mainly focused on factors associated with the birth context, and far less on individual characteristics. This study aimed to examine whether individual characteristics and previous traumatic experiences explained CB-PTSD symptoms and whether individual characteristics and birth satisfaction interacted in their effect on CB-PTSD. Findings showed that all individual characteristics examined were associated with CB-PTSD. However, in multivariate models CB-PTSD was most strongly predicted by previous sexual trauma, higher neuroticism and lower birth satisfaction. Additionally, birth satisfaction moderated the relationship between neuroticism and resilience with CB-PTSD symptoms. These findings are discussed below.

Childbirth is a good research model to study how pre-traumatic experiences contribute to the development of PTSD, as pre-trauma variables can be measured before the index trauma event, unlike in other types of traumatic experiences (e.g., accidents, assaults, natural disasters, etc.). Using the childbirth model it is therefore possible to investigate which factors contribute to PTSD more: individual characteristics and traumas experienced before the birth or the context of the birth itself. Our findings show that the answer is complex. CB-PTSD symptoms comprise two factors: *birth-related symptoms*, including intrusions and avoidance symptoms, and *general symptoms*, including hyperarousal and negative cognitions and mood (Ayers et al., 2018; Nakić Radoš, Matijaš, Kuhar et al., 2020). Our findings show that these clusters of symptoms are affected by different factors. Individual characteristics were more strongly associated with the CB-PTSD General symptoms, whilst the childbirth experience was more strongly associated with the CB-PTSD Birth-related symptoms. This is consistent with previous research which finds CB-PTSD General symptoms are

more strongly associated with general vulnerability factors such as depression, neuroticism and optimism whereas CB-PTSD Birth-related symptoms are more strongly associated with birth events and complications (Handelzalts et al., 2022; Nakić Radoš et al., 2022; Nakić Radoš, Matijaš, Anđelinović, et al., 2020).

Sexual assault and previous traumatic childbirths were significant predictors of CB-PTSD, which is in line with previous studies (Berman et al., 2021; El Founti Khsim et al., 2022). However, somewhat different patterns were identified for different subscales. Namely, sexual assault was a significant predictor of CB-PTSD total symptoms while previous traumatic childbirth was a significant predictor of CB-PTSD General symptoms. This may be because women who have previous traumatic birth experiences have negative expectations of the current birth, which may exacerbate or re-trigger symptoms and make them more vulnerable to PTSD after the current childbirth. It is also possible that in multiparous women who have had a previous traumatic childbirth some of the general symptoms, i.e. hyperarousal and negative cognitions and mood, persist from the previous traumatic childbirth.

For individual characteristics this study examined neuroticism (Garthus-Niegel et al., 2015; Handelzalts et al., 2022; Srkalović Imširagić et al., 2017), anxiety sensitivity (Keogh et al., 2002; Verreault et al., 2012), and resilience (Brown et al., 2022; Dikmen Yildiz et al., 2018). Higher levels of neuroticism and anxiety sensitivity (both psychological concerns and physical aspects), and lower levels of resilience were associated with higher levels of CB-PTSD symptoms on a bivariate level. However, in a regression analysis, only neuroticism was a significant predictor when other variables were included. Given the moderate correlations between neuroticism and both anxiety sensitivity and resilience, neuroticism explained all the variance of CB-PTSD symptoms, making it a strong antenatal predisposing risk factor for CB-PTSD.

In line with findings from previous meta-analyses (Ayers et al., 2016), birth satisfaction was one of the most important factors contributing to CB-PTSD symptoms. We were also interested in whether birth satisfaction interacted with individual characteristics. Previous studies on some

individual characteristics (perfectionism and intolerance of uncertainty), found that birth experience was not a significant moderator between these personality traits and CB-PTSD symptoms (Price et al., 2020). However, in our study, birth satisfaction was a significant moderator of the relationship between neuroticism and resilience with PTSD symptoms, making the association between higher neuroticism/lower resilience and higher CB-PTSD symptoms stronger when birth satisfaction was low. It is important to note that birth satisfaction is a complex and multidimensional construct (Sawyer et al., 2014), comprising the appraisals of stress during birth, women's personal attributes, and quality of care (Hollins Martin & Martin, 2014). These dimensions are differentially associated with PTSD symptoms, where all contribute to Birth-related CB-PTSD, but only women's attributes contribute to General symptoms of CB-PTSD (Nakić Radoš et al., 2022). Satisfaction with birth is one of the outcome measures of quality of peripartum care (World Health Organization, 2016) so it is essential to take it into account. These findings can inform healthcare professionals on the importance of maximising positive birth experiences and providing compassion and respect (Ayers et al., 2023), especially to women who have high neuroticism so may be prone to experiencing negative emotions in stressful situations.

Although resilience was not a significant predictor of CB-PTSD symptoms when all other variables were taken into account, it did interact with birth satisfaction. Women who had low resilience capacity during pregnancy reported higher levels of CB-PTSD General symptoms, and this effect was stronger in women who reported lower levels of birth satisfaction. It is interesting to note that even women with high resilience capacity could not compensate for low birth satisfaction, and they had higher levels of CB-PTSD General symptoms compared to women with low resilience and high birth satisfaction (Figure 1b). This highlights the need to invest in efforts to ensure women's birth experiences are as positive as possible.

It should be noted that 1.8% of women in this study fulfilled the criteria for CB-PTSD following childbirth, which is less than the 4% prevalence rate found in meta-analyses (Dikmen Yildiz et al., 2017; Heyne et al., 2022), and much less than 11.8% found by a previous online study

in Croatia (Nakić Radoš, Matijaš, Anđelinović et al., 2020). The same measure of PTSD (the City BiTS) was used in the latter and current study, so the results are directly comparable. However, the previous Croatian study included women up to 12 months postpartum who were recruited online. These methodological differences, particularly in sampling procedures, could explain differences in prevalence rates between online and community sampling (Ayers et al., 2009), with the prevalence rate from the current study probably being closer to the one in the postpartum population.

Several limitations of this study should be taken into account. The sample were recruited through only one maternity ward so future research would benefit from engaging more hospitals. Although the response rate was quite high at 70%, it is possible that women who had experienced more traumatic childbirths did not want any reminders of the childbirth and avoided responding to the follow-up questionnaires. However, women who participated in the follow-up did not differ from the non-completers in any of the variables associated with PTSD. The previous Croatian study on PTSD following childbirth used the same questionnaire but over a longer timeframe - namely up to 12 months postpartum (Nakić Radoš, Matijaš, Kuhar et al., 2020). This showed that 78% of women reported PTSD symptoms onset within the first six months, meaning one in five women had a delayed onset. Given that the current study assessed PTSD symptoms 6-12 weeks postpartum, it would be useful to have additional measurement points at 6 months postpartum and around the child's first birthday, which may be a reminder of the trauma for some women. Also, despite the CITY BiTS questionnaire examining all diagnostic criteria, future research should use diagnostic interviews which are the recognized gold standard for establishing prevalence.

To conclude, our findings show that previous trauma and individual characteristics, specifically neuroticism, contribute as pre-birth vulnerability factors to the development of CB-PTSD. Although resilience was not a significant predictor of CB-PTSD, it interacted with birth satisfaction meaning women with low resilience capacity and low birth satisfaction were at greater risk of developing CB-PTSD. Future studies should therefore investigate the interplay between pre-term vulnerability, resilience and birth experience in developing CB-PTSD.

These findings also highlight the importance of identifying women with vulnerabilities. However, although there are many instruments available to evaluate birth experiences (Nilvér et al., 2017) and CB-PTSD (e.g., Ayers et al., 2018; Williams et al., 2023), screening tools for assessing the risk of developing CB-PTSD are still lacking. Future studies should put an effort in designing such a tool that is easy for administration. Health care professionals and mental health practitioners should be offered training and support to implement such screening. Women identified as at risk should be offered additional support or personalised care. Emphasis should also be put on providing trauma-informed care (Horsch et al., 2024) and empowering women during birth, involving them in decision-making and assuring respectful communication and support. Maternal health care should work continuously on preventing traumatic experiences arising in the first place, and providing evidence-based screening and treatment programs.

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Table 1*Correlations between individual characteristics and birth satisfaction with CB-PTSD symptoms (N = 396)*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	<i>M (Sd)</i>
1. Neuroticism	-	.48**	.40**	.53**	-.49**	-.20**	.37**	.18**	.41**	25.07 (6.58)
2. ASI Total score		-	.93**	.84**	-.43**	-.20**	.27**	.14**	.30**	16.79 (9.46)
3. ASI Physical concerns			-	.62**	-.37**	-.15**	.23**	.11*	.25**	8.01 (6.10)
4. ASI Psychological concerns				-	-.44**	-.22**	.28**	.13**	.31**	4.44 (3.56)
5. Resilience					-	.15**	-.19**	-0.09	-.21**	3.43 (0.62)
6. BSS-R Birth satisfaction						-	-.52**	-.59**	-.28**	26.25 (6.80)
7. CITY BiTS – Total score							-	.78**	.85**	8.17 (8.94)
8. CITY BiTS – Birth-related symptoms								-	.33**	3.25 (4.96)
9. CITY BiTS – General symptoms									-	4.93 (5.98)

Note: ASI – Anxiety Sensitivity Index; BSS-R Birth Satisfaction Scale-Revised; CITY BiTS – City Birth Trauma Scale. * $p < .05$, ** $p < .01$.

Table 2

Prediction of CB-PTSD symptoms based on previous traumatic experience, individual characteristics, and birth experience (N = 396)

Predictors	Total PTSD symptoms			Birth-related PTSD symptoms			General PTSD symptoms			
	β	<i>t</i>	<i>p</i>	β	<i>t</i>	<i>p</i>	β	<i>t</i>	<i>p</i>	
Step 1										
Constant		3.25	.001		1.68	.094		3.41	.001	
Relationship status ^a	0.06	1.13	.258	0.05	1.00	.319	0.04	0.85	.397	
Previous sexual trauma	0.14	2.93	.004	0.11	2.30	.022	0.12	2.41	.016	
<i>Previous traumatic childbirth</i>										
Multiparous without trauma vs. primiparous	0.21	3.90	.000	0.22	4.01	.000	0.13	2.45	.015	
Multiparous without trauma vs. multiparous with trauma	0.15	2.86	.004	0.08	1.62	.105	0.15	2.88	.004	
			$R^2 = .075;$				$R^2 = .063;$			
			$F(395, 4) = 7.93;$				$F(395, 4) = 6.61;$			
			$p < .001$				$p < .001$			
Step 2										
Constant		-2.12	.035		-0.84	.402		-2.42	.016	
Relationship status ^a	0.02	0.34	.732	0.03	0.62	.535	0.00	-0.04	.969	
Previous sexual trauma	0.11	2.35	.019	0.10	1.99	.047	0.08	1.75	.082	
<i>Previous traumatic childbirth</i>										
Multiparous without trauma vs. primiparous	0.22	4.36	.000	0.22	4.13	.000	0.14	2.86	.004	
Multiparous without trauma vs. multiparous with trauma	0.10	2.13	.033	0.06	1.23	.220	0.10	2.10	.036	
Neuroticism	0.32	5.56	.000	0.16	2.54	.011	0.35	6.06	.000	
ASI Physical concerns	0.04	0.68	.495	0.01	0.09	.925	0.06	0.94	.349	
ASI Psychological concerns	0.07	1.17	.245	0.03	0.49	.621	0.08	1.30	.193	
Resilience	0.03	0.53	.598	0.01	0.15	.879	0.04	0.65	.514	
			$R^2 = .207;$				$R^2 = .093;$			

	$\Delta R^2 = .132;$ $F(395, 8) = 12.63;$ $p < .001$			$\Delta R^2 = .030;$ $F(395, 8) = 4.94;$ $p < .001$			$\Delta R^2 = .161;$ $F(395, 8) = 12.66;$ $p < .001$		
Step 3									
Constant		2.12	.035		4.73	.000		-0.64	.523
Relationship status ^a	0.01	0.21	.834	0.02	0.44	.662	0.00	-0.04	.967
Previous sexual trauma	0.08	1.97	.049	0.06	1.58	.115	0.07	1.50	.135
<i>Previous traumatic childbirth</i>									
Multiparous without trauma vs. primiparous	0.09	1.95	.052	0.05	0.99	.323	0.10	1.91	.057
Multiparous without trauma vs. multiparous with trauma	0.09	1.92	.055	0.04	0.82	.411	0.10	2.00	.046
Neuroticism	0.28	5.30	.000	0.09	1.81	.071	0.34	5.85	.000
ASI Physical concerns	0.05	0.86	.388	0.01	0.24	.814	0.06	1.00	.319
ASI Psychological concerns	0.02	0.41	.679	-0.03	-0.50	.616	0.06	0.93	.351
Resilience	0.05	0.95	.345	0.03	0.57	.566	0.05	0.85	.393
<i>Mode of birth ^b</i>									
Vaginal vs. emergency c.s.	0.04	0.89	.373	0.10	2.26	.024	-0.02	-0.47	.636
Vaginal vs. planned c.s.	-0.08	-1.88	.061	-0.09	-2.04	.042	-0.05	-1.03	.305
Birth satisfaction	-0.41	-9.08	.000	-0.54	-11.94	.000	-0.17	-3.44	.001
	$R^2 = .368;$ $\Delta R^2 = .161;$ $F(395, 11) = 20.34;$ $p < .001$			$R^2 = .381;$ $\Delta R^2 = .288;$ $F(395, 11) = 21.52;$ $p < .001$			$R^2 = .211;$ $\Delta R^2 = .020;$ $F(395, 11) = 10.62;$ $p < .001$		

Note: ^aRelationship status: 1-married, 2-cohabiting, 3-other; ^b there was only one participant in the instrumental vaginal birth group, who was excluded from this analysis; ASI – Anxiety Sensitivity Index.

Table 3*Moderating effect of birth satisfaction in relationship between individual characteristics and CB-PTSD symptoms (N = 396)*

	B	SE (B)	t	p	ΔR^2	F (392, 1)	p
Neuroticism → Total PTSD symptoms	-.018	.008	-2.268	.024	.009	5.147	.024
Neuroticism → Birth-related PTSD symptoms	-.004	.004	-0.956	.339	.002	0.915	.339
Neuroticism → General PTSD symptoms	-.014	.006	-2.372	.018	.011	5.628	.018
ASI Physical Concerns → Total PTSD symptoms	-.011	.010	-1.180	.239	.003	1.393	.239
ASI Physical Concerns → Birth-related PTSD symptoms	.000	.005	0.028	.978	.000	0.001	.978
ASI Physical Concerns → General PTSD symptoms	-.011	.007	-1.610	.108	.006	2.591	.108
ASI Psychological Concerns → Total PTSD symptoms	.003	.015	0.187	.852	.000	0.035	.852
ASI Psychological Concerns → Birth-related PTSD symptoms	.001	.008	0.159	.874	.000	0.025	.874
ASI Psychological Concerns → General PTSD symptoms	.002	.011	.0139	.890	.000	0.019	.890
Resilience → Total PTSD symptoms	.130	.083	1.568	.118	.005	2.457	.118
Resilience → Birth-related PTSD symptoms	.009	.044	0.195	.846	.000	0.038	.846
Resilience → General PTSD symptoms	.122	.062	1.969	.049	.009	3.877	.049

Note: ASI – Anxiety Sensitivity Index.

Figure 1

Moderating Effect of Birth Satisfaction in the Association between Neuroticism and CB-PTSD

General symptoms (Figure 1a) and Resilience and CB-PTSD General symptoms (Figure 1b)

